may be placed into recesses formed in the channel bottom at specific locations along the length of each channel **42** so that only the top surface of each pad is exposed to the conjugate fluid sample solution. In various embodiments, the sensor pads **45** may be placed into each channel **42** so that a gap of between about 0.05 mm to about 0.5 mm between the top surface of each sensor pad **45** and the channel roof is provided. For example, nitrocellulose pads incorporating antibody or antigen receptors or for glass fibre pads bearing MIP receptors, the length of each of the sensor pads **45** could be set at between about 2 mm and about 20 mm.

**[0082]** In various embodiments, fluid flow may be regulated by setting the relative dimensions of the channel vents **47** with respect to the intended flow rate and viscosity of the sample fluid. For example, the diameter of a round channel vent **47** could be set to 0.8 mm for fluids with viscosities of 1-20 cp. However, irrespective of shape the size of the opening of the channel vents **47** may range from about 0.1 mm to 5 mm.

**[0083]** In various embodiments, fluid flow may be regulated either by setting the dimensions of each of the fluidic channels **42** of the chip **26** at various locations and/or by application of a surface treatment and/or by placement of pads of materials that impede fluid transport when wet, e.g., cotton, wool, etc., at appropriate locations inside a channel **42**.

**[0084]** The ease of fluid retrieval by the cartridge **11** and of fluid flow through the channels **42**, with pads **43**, **45** and **46** in place, of the chip **26** may be illustrated by considering a variety of fluid types: pooled oral fluid, frozen for storage and thawed for use (viscosity near 1.0 cp); Pooled oral fluid, not frozen (viscosity near 1.0 cp); Artificial saliva with 2 mg/mL of hog gastric mucin (viscosity of approx. 1.4 cp); Aqueous buffer solutions spiked with drugs of abuse and various concentrations of bovine salivary mucin to tune viscosity from 1.0 cp to 7.2 cp; Glycerol in three dilutions providing increasing levels of viscosity from 12.79 cp, 20.61 cp to 37.15 cp, respectively. For example, when approximately 1.3 ml of oral fluid newly acquired from a donor on a swab was tested with an exemplary cartridge an average sample volume of 1.0 ml was retrieved by the cartridge **11**, following less than 10 sec of compression, with the swab retaining the remainder of the sample. Using the fluids listed above we found that the cartridge **11** successfully transferred sufficient fluid samples from a swab **30** into channels **42** with the fluids flowing all the way through the reagent **43**, sensor **45**, and absorbent **46** pads, respectively in less than 30 sec.

**[0085]** The reagent pads **43** and the absorbent pads **46** may be made from, for example, glass fibre or other suitable absorbent porous material. The sensor pad **45**, comprise substrates that may be made from, for example, nitrocellulose membranes, or other suitable materials, that incorporate immobilised antibodies and/or antigens and/or MIP particles, or porous or non-porous substrates that bear chemically grafted MIP layers. A porous substrate could, for example, be a macroporous, mesoporous or nanoporous oxide material, such as glass fibre, silicon dioxide, silica or alumina or another porous oxide material with a surface that can be activated to allow the attachment of initiator moieties for the initiation of a grafted MIP layer onto the substrate surface. In various embodiments, the chemically bonded thin polymer layer would have minimal swelling such that, e.g., MIP grafted substrates would be mechanically stable in different solvents, during operation and prolonged storage. In various embodiments, the thin grafted MIP layer does not interfere with transport and provides the desired chemical selectivity. In various embodiments, grafting of MIP to pad substrates in a thin layer provides a substantial reduction in the level of released template.

**[0086]** In certain embodiments, the use of porous pads in combination with fluidic channel may ensure good transport for viscous liquids and heterogeneous samples about and through such substrates. The fluid to be analysed must also pass over or through a pad, which may improve the speed of the analysis assay by concentrating the small amounts of materials involved onto a small area to facilitate subsequent highly sensitive detection. Pad substrates are also useful because they are amenable to further miniaturisation and generally have high mechanical and chemical stability. In various embodiments, the use of such substrates can also facilitate, e.g., processing of the pad material, and pad placement at desired locations within each channel **42** of the fluidic chip **26**, using techniques that are amenable to cost-effective, high volume manufacturing, such as surface pre-treatment with reagents or other agents, for example, blocking agents, by dipping, vapour exposure, aerosol spraying or liquid droplet deposition, and pad positioning and assembly by pick-and-place methods. In various embodiments, one advantage of the use of pick-and-place methods for chip assembly is that known-good-pads, identified by pre-screening, may be selected for placement, thereby providing a way to maximise manufacturing yield. Pick-and-place methods are also compatible with rapid, automated optical inspection during manufacturing and with subsequent product miniaturisation.

**[0087]** To facilitate that accurate data signal measurements may be carried out at each active sensor location on the fluidic chip **26** using the reader **13**, the chip **26** is equipped with a number of mechanical alignment features **48** that provide reproducible and robust registration with the internal mechanics of the detection module **13** by direct contact. Referring to FIG. **2**, in the fluidic chip **26** may be integrated into the cartridge **11** by sandwiching it between planar seals **27**, and the cartridge front **21** and rear **22**. According to such embodiments, when the cartridge **11** is fully assembled, the chip **26** sits over the placement features **28**, which precisely position the chip **26** within the extraction chamber **23**. Referring to FIG. **4**, the features **49** on the fluidic chip **26** may be designed to correspond to and match with the placement features **28** in order to facilitate the positioning of the chip **26** with respect to the extraction chamber **23**. In turn, this positioning facilitates the mechanical alignment feature **48** on the fluidic chip **26** to protrude outside of the cartridge **11** thereby providing direct registration between the chip **26** and the reader **13**.

**[0088]** Various aspects and embodiments of the present inventions may be illustrated by employing the convenient format of a flow-type assay whereby a fluid sample and the products of displacement, competition or sandwich affinity assays move through a fluidic chip, producing labelled zones that can be read by eye and/or by an optical transducer.

**[0089]** Referring to FIG. **5***a*, an exemplary cartridge **11** is shown standing upright with a swab **30** inserted into the extraction chamber **23** and with the hinged lid **24** in open **51** and closed **52** positions, respectively. To carry out a fluorescence-based assay using oral fluid, for example, a fluid sample of sufficient volume is collected by a swab **30**. Upon insertion of the swab **30** into the extraction chamber **23** and closure of the hinged lid **24**, the swab head **32** is compressed